

**Canada.**—**Montreal:** this city was visited by a flood during the 18th, 19th, and 20th. Business was at a complete standstill. Hundreds of wholesale and retail houses were closed, being inaccessible except by boats. The suffering of the residents in the flooded part of the city was intense. In Griffintown thousands of persons were forced to the upper part of their houses by the water. Twenty-four streets were reported covered with water to the depth of five feet. The flood showed signs of abatement on the 20th.

#### HIGH TIDES.

Eastport, Maine, 6th.  
Block Island, Rhode Island, 6th, 20th.  
New Haven, Connecticut, 6th.  
Sandy Hook, New Jersey, 6th.  
Atlantic City, New Jersey, 6th.

#### LOW TIDES.

Indianola, Texas, 1st, 5th to 11th, 16th, 17th, 19th to 23d, 30th.

#### VERIFICATIONS.

##### INDICATIONS.

The detailed comparison of the tri-daily indications for districts east of the Rocky Mountains during April, 1886, with the telegraphic reports for the succeeding thirty-two hours, shows the general average percentage of verifications to be 80.19 per cent. The percentages for the four elements are: Weather, 83.02; direction of the wind, 82.39; temperature, 75.31; barometer, 76.39 per cent. By geographical districts, they are: For New England, 68.57; middle Atlantic states, 79.53; south Atlantic states, 85.58; eastern Gulf states, 87.68; western Gulf states, 84.28; lower lake region, 75.00; upper lake region, 79.49; Ohio Valley and Tennessee, 82.29; upper Mississippi valley, 80.79; Missouri Valley, 78.87. There were eight omissions to predict, out of 2,736, or 0.29 per cent. Of the 2,728 predictions that have been made, eighty-five, or 3.12 per cent., are considered to have entirely failed; one hundred and seventy-seven, or 6.49 per cent., were one-fourth verified; four hundred and twenty-five, or 15.57 per cent., were one-half verified; four hundred and forty-one, or 16.17 per cent., were three-fourths verified; 1,600, or 58.65 per cent., were fully verified, so far as can be ascertained from the tri-daily reports.

The percentages of verifications of special predictions for certain localities are, as follows:

Omaha, Nebraska (twenty-six days), 79.81; Arkansas (twenty-six days), 86.54; Baltimore, Maryland (twenty-six days), 71.64; Washington City, 75.41; Portland, Maine, 70.83; Boston, Massachusetts, 68.75; New Haven, Connecticut, 71.67; Albany, New York, 72.50; Pittsburg, Pennsylvania, 74.17; Cincinnati, Ohio, 74.17; Louisville, Kentucky, 70.00; Indianapolis, Indiana, 65.83; Columbus, Ohio, 62.07; Oswego, New York, 69.58; Rochester, New York, 72.50; Buffalo, New York, 69.17; Erie, Pennsylvania, 69.17; Cleveland, Ohio, 65.00; Davenport, Iowa, 72.91; Toledo, Ohio, 74.58; Sandusky, Ohio, 61.67; Milwaukee, Wisconsin, 73.73; Chicago, Illinois, 76.25; Lynchburg, Virginia, 79.17; Georgia, 84.58; northern Florida, 89.17; Shreveport, Louisiana, 67.50; Tennessee, 74.58; Memphis, Tennessee, 80.00; Saint Louis, Missouri, 74.17; Cairo, Illinois, 81.67; western Missouri, 79.17; Iowa, 81.67; Saint Paul, Minnesota, 85.00; Nebraska (seventeen days), 77.94; Palestine, Texas (twelve days), 75.00.

#### CAUTIONARY SIGNALS.

During April, 1886, one hundred and thirty-six cautionary signals were ordered. Of these, seventy-six, or 55.88 per cent., were justified by winds of twenty-five miles or more per hour at or within one hundred miles of the station. Sixteen cautionary off-shore signals were ordered, of which number, eight, or 50.00 per cent., were fully justified, both as to direction and velocity; sixteen, or 100 per cent., were justified as to direction; and eight, or 50.00 per cent., were justified as to velocity. One hundred and fifty-two signals of all kinds

were ordered, eighty-four, or 55.26 per cent., being fully justified. These do not include signals ordered at display stations where the velocity of the wind is only estimated. Of the above cautionary off-shore signals, twelve were changed from cautionary. Two signals were ordered late. In fifty-nine cases, winds of twenty-five miles or more per hour were reported for which no signals were ordered.

#### COLD-WAVE SIGNALS.

No cold-wave signals were ordered during April.

#### RAILWAY WEATHER SIGNALS.

Prof. P. H. Mell, jr., director of the "Alabama Weather Service," in the report for April, 1886, states:

The verifications of predictions for the whole area was 93 per cent. for temperature, and 90 per cent. for weather.

The following corporations comprise this system: South and North; Montgomery and Mobile; Mobile and Girard; Georgia Pacific; East Tennessee, Virginia and Georgia system in Alabama; Memphis and Charleston; Columbus Western; Atlanta and West Point of Georgia; Northeastern of Georgia; Western and Atlantic; East Tennessee, Virginia and Georgia system in Georgia; Montgomery and Eufaula; Pensacola and Selma; Pensacola and Atlantic; and the cities of Milledgeville, Georgia, and Talladega, Alabama.

#### ATMOSPHERIC ELECTRICITY.

##### AURORAS.

Auroral displays were not very numerous during April, 1886. The most brilliant and extensively observed display was that of the 20th; it was generally observed in the northern districts from Montana eastward to Maine.

The following notes refer to the displays reported during the month:

Prairie du Chien, Crawford county, Wisconsin: a white auroral arch above a dark segment was observed during the evening of the 1st.

Fort Yates, Dakota: an aurora was observed from 9.38 to 10.50 p. m. of the 1st. The auroral light consisted of a horizontal bar of white light extending from northwest to southeast. An aurora was also observed on the 20th, from 10.30 to 11.20 p. m.

Bismarck, Dakota: an aurora was observed from 9.45 to 11.20 p. m. on the 1st, having two separate pillars of light 5° wide and 30° altitude. The light was a pale yellow color, the maximum brilliancy occurring at 10.15 p. m.

Escanaba, Michigan: faint aurora observed at 10 p. m. on the 4th, and continued until after midnight. On the 12th a faint orange-colored arch 20° above the horizon was observed about 9 p. m.

Saint Vincent, Minnesota: an aurora was observed at 9.35 p. m. of the 12th, consisting of a pale whitish light shooting up to a height of 20°.

Gardiner, Kennebec county, Maine: on the 14th a brilliant aurora was observed at 10.45 p. m., with beams flashing up towards the zenith. At 2.30 a. m. the aurora was still visible but fainter on account of the moon which was then shining brightly.

Cambridge, Massachusetts: a faint auroral arch was observed from 8.30 to 9.45 p. m. of the 14th, which increased in brightness until about 11 p. m., when it began to fade away. An aurora was also seen at 10 p. m. of the 30th. This aurora was low and irregular with some appearance of streamers, with dark sky below; later a faint arch appeared. The display ended at 11 p. m.

Mackinaw City, Michigan: an aurora of 15° altitude and 30° azimuth was seen on the 20th during the evening. It was so faint that it could not be seen after the moonlight began.

Poplar River, Montana: a pale yellow aurora was seen at 10.30 p. m. of the 20th. Numerous beams, not well defined, rose to the altitude of 30°. The beams were interspersed with dark rays resembling dense smoke. The display ended at 11.30 p. m.

Fort Assinaboine, Montana: a bright auroral display was first seen at 10 p. m. of the 20th, consisting of an arch of pale white color above a dark segment. The arch was about 90° azimuth and 17° to 20° altitude. At midnight it had almost

Table of miscellaneous meteorological data for April, 1886—Signal Service observations.

Stations.	Elevation above sea-level.	Atmospheric pressure (in inches and hundredths).					Temperature of the air (in degrees Fahrenheit).										Winds.															
		Mean actual barometer.	Departure from normal.	Mean reduced barometer.	Extremes.		Monthly mean.	Departure from normal.	Extremes.		Monthly range.	Greatest.	Least.	Date.	Mean rel. humidity.	Mean dew-point.	Precipitation.	Departure from normal.	Total movement.	Prevailing direction.	Maximum velocity.		Date.	No. of rainy days.	No. of cloudy days.	No. of fair days.	No. of clear days.					
					Highest barometer.	Lowest barometer.			Max.	Min.											Miles p. h.	Direction.										
<b>New England.</b>																																
Eastport.....	61	30.04	+ .24	30.11	30.61	16	29.59	23	1.02	40.1	+ 2.1	71.3	19	48.2	24.2	4	33.4	47.1	30.7	19	4.0	1.75	6	32.0	1.14	+	2.66	5,246	s.	58	ne.	7 5 5 9 16
Portland.....	99	30.01	+ .23	30.12	30.61	16	29.63	23	0.98	44.7	+ 1.1	73.8	19	53.0	23.4	4	37.1	50.4	31.6	18	3.7	6.71	3	34.9	2.28	+	0.70	5,362	s.	36	ne.	6 5 7 12 11
Mount Washington.....	6,279	23.78	.....	30.20	30.65	17	29.67	60	0.98	28.5	+ 7.7	82.2	23	35.4	2.3	4	22.5	49.9	23.8	12	4.0	13.88	1	25.1	3.36	+	2.30	18,645	nw.	110	sw.	1 11 5 15 10
Boston.....	125	29.99	+ .20	30.12	30.62	11	29.57	61	0.05	47.7	+ 3.7	84.3	23	56.7	26.9	4	40.6	57.4	34.9	23	4.9	29.68	6	36.6	1.70	+	2.31	7,664	o.	51	e.	6 9 6 14 10
Block Island.....	27	30.10	.....	30.12	30.63	16	29.50	61	1.13	45.2	+ 2.0	89.7	24	52.1	31.9	4	40.6	57.8	25.0	19	4.1	5.88	8	42.0	3.26	+	0.14	8,695	no.	40	ne.	6 11 8 12 10
Narragansett Pier.....	107	30.01	.....	30.12	30.61	16	29.49	61	1.12	48.4	.....	81.0	24	57.0	30.4	4	39.7	51.0	.....	.....	.....	.....	38.5	3.21	+	0.81	4,988	ne.	39	ne.	6 12 11 14 5	
New Haven.....	47	30.09	+ .18	30.13	30.63	11	29.54	61	1.09	48.1	+ 2.9	77.4	24	56.7	31.5	9	41.3	45.9	30.0	24	6.7	4.75	6	40.1	3.63	+	0.24	4,768	se.	30	sw.	1 11 4 20 6
<b>Mid. Atlantic States.</b>																																
Albany.....	83	30.05	+ .18	30.13	30.56	11	29.55	61	1.01	50.4	+ 5.2	83.5	23	61.4	25.7	4	41.3	57.8	32.8	18	4.6	8.68	4	39.4	3.67	+	1.08	3,576	s.	39	se.	1 13 12 14 4
New York City.....	168	29.94	+ .15	30.11	30.57	17	29.44	61	1.13	50.3	+ 3.2	84.0	22	60.2	29.4	4	42.6	54.6	33.4	19	5.9	5.72	8	40.6	4.95	+	1.79	6,220	no.	40	ne.	6 9 6 15 9
Philadelphia.....	117	29.99	+ .13	30.11	30.56	17	29.37	61	1.18	53.4	+ 3.6	81.4	24	60.3	29.3	4	44.8	55.1	33.2	19	5.3	5.74	0	44.1	2.70	+	0.30	6,545	ne.	43	sw.	1 7 11 14 5
Atlantic City.....	13	30.03	+ .13	30.08	30.50	17	29.38	61	1.13	48.0	+ 1.6	83.4	24	54.8	28.4	9	41.0	55.0	29.5	24	4.3	5.82	3	42.2	1.86	+	1.63	7,638	e.	32	ne.	5 6 5 13 12
Sandy Hook.....	28	30.08	+ .14	30.10	30.55	17	29.42	61	1.13	48.7	+ 2.5	80.0	22	57.7	31.0	4	42.8	49.0	33.0	19	3.0	5.79	8	42.0	5.06	+	0.68	10,769	e.	30	ne.	6 15 6 14 10
Cape Henlopen.....	45	30.05	+ .09	30.08	30.52	17	29.38	61	1.14	52.5	+ 4.4	76.4	15	58.0	36.0	4	47.0	40.4	.....	.....	.....	.....	43.2	2.06	+	1.01	4,085	ne.	28	sw.	1 7 8 13 9	
Baltimore.....	106	29.99	+ .09	30.09	30.51	17	29.40	61	1.12	50.6	+ 1.6	87.8	24	64.3	33.8	4	46.9	54.0	28.9	9	3.8	5.69	1	43.2	2.06	+	1.01	4,085	ne.	28	sw.	1 7 8 13 9
Ocean City.....	16	30.07	+ .08	30.07	30.42	18	29.42	60	0.99	53.5	+ 0.5	83.6	24	60.3	37.6	9	47.0	46.0	25.9	3	3.1	4.80	6	47.0	1.98	+	3.18	9,705	ne.	40	ne.	30 8 6 10 14
Washington City.....	106	29.99	+ .09	30.09	30.51	17	29.40	61	1.12	55.5	+ 2.9	88.1	24	65.3	34.5	4	46.3	53.6	34.2	19	4.7	5.75	7	46.9	2.71	+	0.19	4,281	e.	30	nw.	24 9 11 11 8
Cape Henry.....	16	30.07	+ .08	30.07	30.42	18	29.42	60	0.99	53.5	+ 0.5	83.6	24	60.3	37.6	9	47.0	46.0	25.9	3	3.1	4.80	6	47.0	1.98	+	3.18	9,705	ne.	40	ne.	30 8 6 10 14
Chincoteague.....	8	30.09	+ .10	30.08	30.47	17	29.36	61	1.11	51.9	+ 2.3	82.6	23	59.3	37.2	4	44.8	45.4	26.7	25	4.0	4.80	8	45.6	2.59	+	0.44	8,265	ne.	30	ne.	5 12 5 17 8
Lynchburg.....	652	29.39	+ .08	30.07	30.42	17	29.44	60	0.97	57.1	+ 1.3	88.6	24	68.7	31.0	9	46.0	57.6	37.1	19	3.8	5.72	5	46.8	4.82	+	1.42	2,884	ne.	15	nw.	27 12 10 12 8
Norfolk.....	30	30.06	+ .10	30.08	30.41	12	29.43	60	0.96	56.1	+ 0.2	87.0	24	66.3	38.1	9	48.3	48.9	29.3	20	5.4	28.73	4	46.8	3.16	+	0.81	4,450	no.	24	sw.	6 8 8 13 9
<b>South Atlantic States.</b>																																
Charlotte.....	808	29.22	+ .06	30.05	30.35	9	29.58	50	0.77	59.7	+ 0.6	86.6	24	70.6	32.5	8	48.7	54.1	32.7	23	6.3	29.75	2	51.1	3.88	+	0.67	4,441	sw.	22	w.	6 12 8 16 6
Fort Macon.....	11	30.07	+ .08	30.05	30.36	12	29.51	60	0.86	60.6	+ 3.2	71.8	23	66.7	39.7	8	55.8	32.1	16.5	2	4.2	29.86	9	57.6	2.89	+	0.98	10,984	sw.	48	ne.	29 10 8 11 11
Hatteras.....	12	30.07	+ .07	30.06	30.42	12	29.51	60	0.90	58.9	+ 3.0	76.5	27	65.9	38.8	10	53.1	37.7	23.3	23	4.4	29.80	3	52.4	2.97	+	2.57	7,796	ne.	30	w.	6 7 8 9 13
Kitty Hawk.....	9	30.09	+ .07	30.08	30.43	12	29.48	60	0.95	54.2	+ 0.1	84.3	24	60.9	39.3	9	48.6	45.0	29.9	3	3.9	30.80	8	47.6	5.00	+	0.59	10,172	ne.	42	ne.	29 8 6 11 13
New River Inlet.....	34	30.03	+ .03	30.04	30.36	9	29.50	29	0.86	60.9	+ 0.4	75.7	27	67.5	38.2	8	53.9	37.5	31.5	23	6.1	5.84	0	55.8	3.10	+	0.22	8,449	sw.	33	s.	5 9 5 12 13
Smithville.....	52	30.02	+ .05	30.05	30.37	9	29.54	29	0.83	62.1	+ 0.5	86.7	27	72.2	39.4	9	53.1	47.3	30.2	23	9.3	5.71	6	51.7	3.26	+	0.08	5,520	sw.	25	e.	18 7 5 13 11
Wash Woods.....	52	30.03	+ .05	30.05	30.37	9	29.58	29	0.79	62.4	+ 2.0	81.4	24	70.7	39.4	8	55.5	42.0	21.9	1	8.6	28.74	9	53.7	1.19	+	3.48	6,082	e.	32	ne.	18 7 5 12 13
Wilmington.....	183	29.90	+ .02	30.04	30.34	9	29.61	50	0.73	63.1	+ 0.7	88.6	24	75.5	33.6	8	52.3	35.5	35.0	9	6.2	28.66	1	49.4	1.86	+	2.47	3,228	s.	24	nw.	30 8 12 10
Charleston.....	87	29.99	+ .03	30.05	30.36	9	29.65	29	0.71	67.4	+ 1.8	83.4	25	73.2	40.0	8	57.4	43.4	21.2	23	10.0	18.74	9	55.7	2.06	+	2.48	6,968	e.	37	ne.	18 8 5 12 13
Augusta.....	43	30.02	+ .02	30.03	30.30	9	29.67	29	0.63	66.5	+ 2.4	85.6	27	74.8	44.0	8	59.2	41.6	22.1	23	6.3	19.74	0	57.2	3.08	+	0.22	5,526	ne.	36	s.	28 9 6 10 14
<b>Florida Peninsula.</b>																																
Cedar Keys.....	22	30.00	.....	29.98	30.23	9	29.68	29	0.54	65.8	+ 4.6	81.2	15	73.8	44.4	6	59.4	36.8	22.6	9	6.3	17.80	7	59.3	1.61	+	0.99	7,377	ne.	48	s.	5 7 7 9 14
Key West.....	20	29.94	.....	29.91	30.10	24	29.76	16	0.35	74.5	.....	88.1	28	74.8	65.4	20	70.0	22.7	13.3	29	4.9	17.75	8	66.1	1.99	+	0.66	6,683	ne.	38	ne.	29 8 1 12 6
Sanford.....	25	30.03	.....	30.02	30.27	9	29.68	29	0.59	66.1	+ 4.7	86.0	27	74.9	44.2	7	59.4	41.8	26.1	2	5.5	18.73	9	56.4	6.60	+	2.65	5,827	ne.	33	ne.	18 9 5 9 16
<b>Eastern Gulf States.</b>																																
Atlanta.....	1,129	28.89	+ .03	30.05	30.32	9	29.64	28	0.68	60.4	+ 0.4	82.5	23	70.0	31.8	8	51.8	50.7	32.5	8	6.0	7.64	6	47.0	2.52	+	2.66	7,862	se.	33	nw.	30 13 6 13 11
Pensacola.....	30	30.02	+ .00	30.01	30.32	9	29.62	28	0.62	65.3	+ 2.5	82.0	30	72.5	38.6	6	58.8	43.4	24.6	7	3.8	4.74	4	56.3	6.83	+	1.75	5,909	s.	33	s.	28 10 5 13 12
Mobile.....	35	30.02	+ .02	30.02	30.24	9	29.62	28	0.63	63.9	+ 3.1	84.0	22	72.0	37.0	6	56.2	47.0	26.0	7	6.6	27.84	4	55.9	5.86	+	0.11	6,067	se.	30	se.	28 10 4 13 13
Montgomery.....	219	29.82	+ .01	30.02	30.27	9	29.61	28	0.65	63.8	+ 1.2	84.3	24	74.1	36.5	6	54.9	47.8	27.9	21	7.4	4.66	8	50.8	7.38	+	1.11	4,716	e.	24	nw.	5 9 8 7 15
Vicksburg.....	209	29.81	+ .01	30.00	30.23	9	29.66	28	0.57	64.2	+ 1.3	88.0	22	75.2	30.5	5	54.7	57.5	32.5	1	5.3	27.67	7	51.5	9.99	+	2.93	4,481	e.	20	n.	5 13 7 14 9
New Orleans.....	52	29.58	+ .02	30.00	30.22	7	29.60	28	0.61	65.6	+																					

Table of miscellaneous meteorological data for April, 1886—Signal Service observations—Continued.

Stations.	Elevation above sea level.	Atmospheric pressure (in inches and hundredths).						Temperature of the air (in degrees Fahrenheit).													Winds.														
		Mean actual barometer.	Departure from normal.	Mean reduced barometer.	Extremes.		Monthly range of barometer.	Monthly mean.	Departure from normal.	Extremes.		Monthly range.	Daily ranges.				Mean rel. humidity.	Mean dew-point.	Precipitation.	Departure from normal.	Total movement.	Prevailing direction.	Maximum velocity.												
					Highest barometer.	Date.				Lowest barometer.	Date.		Max.	Date.	Mean max.	Min.							Date.	Mean min.	Greatest.	Date.	Least.	Date.	Miles p. h.	Direction.	Date.	No. of rainy days.	No. of cloudy days.	No. of fair days.	
					Highest barometer.	Date.				Lowest barometer.	Date.		Max.	Date.	Mean max.	Min.							Date.	Mean min.	Greatest.	Date.	Least.	Date.	Miles p. h.	Direction.	Date.	No. of rainy days.	No. of cloudy days.	No. of fair days.	
Upper Miss. Valley.																																			
Saint Paul.	831	29.07	+0.02	29.98	30.39	19	29.36	26	1.03	49.2	+4.6	81.3	21	59.4	13.5	2	39.9	67.8	30.2	23	7.5	29	74.0	40.4	3.67	+1.58	5,130	se.	28	se.	14	10	13	11	6
La Crosse.	725	29.20	+0.03	29.98	30.40	19	29.33	26	1.02	52.0	+5.4	81.0	21	61.4	18.6	2	43.9	62.4	25.6	8	8.9	11	70.4	42.2	1.60	+0.34	5,853	se.	25	nw.	14	13	12	7	11
Davenport.	615	29.34	+0.03	30.00	30.38	19	29.54	26	0.84	52.0	+2.9	81.5	21	61.8	13.9	2	43.4	67.7	27.0	8	4.4	11	69.1	41.1	1.84	+1.19	6,652	se.	39	se.	14	8	8	18	4
Des Moines.	849	29.08	+0.03	29.99	30.37	19	29.46	26	0.91	52.7	+3.5	83.5	21	63.3	20.7	2	44.5	62.8	32.1	7	6.6	24	72.9	43.6	4.32	+1.54	3,566	se.	24	sw.	14	14	18	8	4
Dubuque.	665	29.32	+0.03	29.98	30.35	19	29.53	26	0.82	53.6	+2.4	81.9	22	63.8	23.7	5	45.1	58.2	28.0	8	7.0	3	77.5	44.0	1.52	+1.60	7,191	se.	37	se.	16	12	7	15	8
Keokuk.	359	29.64	+0.02	30.00	30.30	19	29.65	28	0.65	55.0	+0.4	80.5	23	65.3	20.0	5	50.9	51.5	23.4	1	2.6	3	65.8	44.8	6.64	+2.53	6,252	se.	29	nw.	5	12	13	12	5
Cairo.	644	29.33	+0.04	29.99	30.33	19	29.60	26	0.74	56.1	+3.3	81.0	23	64.6	24.5	5	47.1	56.5	28.9	8	6.0	16	68.4	45.4	2.98	+0.74	7,411	se.	28	n.	6	8	9	14	5
Springfield.	571	29.40	+0.03	30.00	30.34	19	29.63	26	0.70	59.1	+4.0	84.0	23	67.2	24.1	4	51.6	59.9	26.0	13	5.4	3	70.4	48.8	2.10	+1.40	8,323	se.	33	nw.	1	12	11	12	7
Saint Louis.	571	29.40	+0.03	30.00	30.34	19	29.63	26	0.70	59.1	+4.0	84.0	23	67.2	24.1	4	51.6	59.9	26.0	13	5.4	3	70.4	48.8	2.10	+1.40	8,323	se.	33	nw.	1	12	11	12	7
Missouri Valley.																																			
Lamar.	1,028	28.92	.....	30.00	30.36	5	29.62	28	0.74	54.8	.....	84.0	21	66.1	24.0	5	45.9	60.0	29.3	27	3.8	3	74.0	45.7	1.78	.....	8,260	se.	32	nw.	29	10	10	9	11
Leavenworth.	842	29.11	+0.04	30.00	30.40	5	29.56	25	0.83	54.4	+1.1	87.0	22	65.2	20.5	5	45.5	66.5	32.4	27	4.5	3	70.7	44.5	1.47	+2.40	6,000	se.	32	se.	14	13	14	10	6
Omaha.	1,113	28.81	+0.03	29.99	30.41	5	29.48	25	0.93	50.9	+1.1	84.6	22	64.1	17.8	2	41.8	66.8	32.6	7	10.1	3	68.7	39.7	1.77	+1.78	6,331	se.	34	nw.	26	10	6	15	9
Valentine.	2,603	27.23	.....	29.95	30.40	19	29.41	18	0.99	43.8	.....	88.4	18	64.7	12.6	3	33.8	65.8	38.2	17	7.4	2	62.7	30.3	1.39	.....	10,880	se.	60	n.	25	11	13	10	7
Huron.	1,307	28.54	+0.02	29.99	30.47	5	29.38	14	1.09	46.1	+1.9	83.2	21	59.3	9.0	2	35.0	74.2	44.8	17	9.2	13	77.0	38.8	3.52	+1.00	7,792	se.	39	nw.	26	11	9	12	9
Yankton.	1,228	28.63	+0.01	29.97	30.44	5	29.47	14	0.97	47.6	+2.4	80.1	20	59.8	3.9	2	38.2	76.2	34.7	17	10.1	9	76.1	39.3	5.12	+1.87	7,908	nw.	39	sw.	22	8	7	13	10
Northern slope.																																			
Fort Assinaboine.	2,720	27.04	+0.07	29.95	30.44	19	29.54	13	0.90	46.2	+4.0	78.0	12	60.5	16.4	3	33.0	61.6	39.1	8	10.7	17	53.2	28.4	1.83	+1.04	8,397	sw.	37	nw.	15	6	4	14	12
Fort Benton.	2,681	27.09	.....	29.95	30.47	19	29.46	12	1.01	45.4	+3.3	78.2	12	62.1	19.3	4	33.6	58.9	45.0	20	11.0	17	67.2	35.1	2.01	+1.17	4,360	se.	45	e.	12	8	7	11	12
Fort Custer.	3,040	26.72	+0.06	29.90	30.43	19	29.42	13	1.01	46.1	+1.7	76.8	12	60.4	18.9	4	33.7	57.9	40.3	7	10.9	18	52.8	30.5	1.98	+0.92	5,852	se.	36	n.	30	7	5	17	8
Fort Maginnis.	4,340	25.43	.....	29.93	30.40	19	29.42	14	0.91	41.1	+2.2	72.7	12	54.7	16.2	3	31.1	56.5	36.7	3	7.5	25	59.4	27.4	1.18	+0.51	8,180	nw.	62	nw.	15	11	8	13	9
Fort Shaw.	3,550	26.24	.....	29.92	30.43	19	29.46	12	0.97	45.2	+4.8	74.9	20	60.0	18.9	4	33.9	55.0	47.5	20	10.4	14	60.0	30.9	2.30	+1.61	5,412	w.	32	nw.	14	9	5	14	11
Helena.	4,069	25.72	+0.05	29.93	30.40	19	29.51	12	0.89	42.9	+0.8	71.2	12	55.4	27.2	27	33.2	44.0	34.2	20	8.2	14	58.2	27.8	2.60	+1.47	6,023	sw.	40	sw.	14	7	9	15	6
Poplar River.	2,030	27.76	.....	29.97	30.47	19	29.38	15	1.08	45.2	.....	83.0	12	60.3	12.1	2	30.6	71.0	46.3	6	9.6	15	68.9	34.2	0.86	+0.99	7,147	se.	36	n.	22	6	4	11	15
Deadwood.	4,600	25.37	+0.03	29.96	30.46	19	29.52	14	0.95	41.3	+1.6	69.2	17	49.9	14.9	5	34.3	54.3	30.1	17	4.6	28	73.2	32.7	6.72	+1.01	7,729	sw.	26	sw.	21	6	7	15	8
Cheyenne.	6,105	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	
North Platte.	2,841	27.00	.....	29.94	30.37	5	29.48	14	0.89	47.2	+0.2	82.0	18	59.5	16.2	3	37.9	65.8	37.2	17	10.6	2	75.5	39.1	2.09	+0.27	7,958	se.	48	se.	18	11	8	15	7
Fort Laramie.	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	
Middle slope.																																			
Denver.	5,294	24.63	+0.02	29.89	30.34	19	29.42	12	0.92	44.2	+1.8	74.6	17	56.5	20.5	3	34.6	54.1	35.8	17	12.5	3	60.7	28.4	2.79	+0.73	6,262	n.	32	n.	28	16	12	13	5
Pike's Peak.	14,134	17.62	.....	29.89	30.20	29	29.53	10	0.68	12.0	+0.8	76.3	10	7.8	4.0	5	7.6	31.8	15.5	30	4.5	9	87.2	8.9	6.32	+2.83	14,930	w.	68	w.	7	15	7	12	11
West Las Animas.	3,809	25.97	+0.06	29.90	30.26	5	29.44	12	0.82	42.2	+1.4	85.3	18	64.4	9.2	5	35.9	76.3	50.5	17	11.1	25	64.3	34.1	2.64	+1.79	7,532	se.	50	se.	18	9	9	14	7
Concordia.	1,384	28.48	.....	29.95	30.41	5	29.48	25	0.93	51.0	.....	82.8	22	63.0	17.6	6	40.5	65.2	36.3	27	4.2	3	70.0	39.6	3.39	.....	8,359	se.	44	se.	13	11	7	12	11
Dodge City.	2,517	27.34	+0.03	29.94	30.37	5	29.51	13	0.83	51.0	+1.9	79.0	18	63.7	18.4	6	39.9	66.2	35.4	7	7.6	4	67.3	38.6	1.90	+0.65	10,997	se.	56	sw.	14	6	6	10	14
Fort Reno.	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	
Fort Supply.	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	
Fort Elliott.	2,650	27.18	+0.05	29.94	30.32	5	29.58	28	0.74	53.9	+1.7	78.9	18	67.2	20.3	5	42.4	58.6	36.5	7	8.4	3	62.1	39.1	2.44	+1.00	11,106	se.	50	se.	23	7	4	13	13
Southern slope.																																			
Fort Sill.	1,200	28.72	+0.02	29.93	30.35	6	29.56	28	0.79	59.7	+2.3	84.0	14	73.1	27.0	5	48.1	57.0	40.6	1	9.0	4	57.6	41.9	1.60	+0.86	9,965	se.	44	se.	12	5	5	11	14
Abilene.	1,745	28.16	.....	29.98	30.42	5	29.66	28	0.76	61.5	.....	80.7	28	74.0	25.0	5	50.5	64.5	39.6	1	13.9	4	67.6	44.4	1.67	.....	8,782	se.	44	se.	12	5	3	10	17
Fort Davis.	4,928	25.10	+0.05	29.85	30.10	5	29.55	12	0.45	59.8	+0.9	84.2	30	75.5	23.8	5	45.6	60.4	42.7	17	14.7														

disappeared, but it began to revive again and reached its maximum intensity at 2.25 a. m., after which it began to fade away. Nostreamers were seen. The effect of the atmospheric electricity was plainly noticeable on the telegraph line, being almost strong enough to work the line without a battery.

Fort Buford, Dakota: an aurora began at 10.17 p. m. of the 20th, having, on its first appearance, an outline of a bank of illuminated smoke, from which, at intervals, streamers of a bluish tint shot up to a height of 75° or 80°. About 10.55 p. m. it assumed the form of a well-defined arch and remained visible until about 11.45 p. m.

Alpena, Michigan: aurora first noticed at 9.30 p. m. of the 20th, consisting of a diffused light in the northwestern horizon from which a few streamers were observed to shoot up to an altitude of about 40°.

Marquette, Michigan: an aurora was observed at 10 p. m. on the 20th, extending across the entire sky, passing a few degrees north of the zenith.

Moorhead, Minnesota: a faint aurora was observed on the 20th at 10 p. m., disappearing at 11.30 p. m. Auroras were also observed during evenings of the 14th and 30th.

Gardiner, Kennebec county, Maine: on the 24th a brilliant aurora appeared at about 10.30 p. m. with faint beams which increased in brightness until 12 midnight; at 1.30 a. m. the aurora appeared in the form of a double arch, the lower one quite near the horizon. Bright streamers shot up from both of the arches until 3.30 a. m., when the aurora was nearly obscured by the moon.

Burlington, Vermont: a very brilliant aurora was observed at 1.00 a. m. of the 25th. It consisted of an orange-colored light extending from northeast to west, rising to an altitude of about 25°. The light produced by the aurora was bright enough to cast a shadow. The western extremity gradually faded out, but in the northwest the aurora was rendered more brilliant by perpendicular rays of light, rising to a height of 30°.

Tatoosh Island, Washington Territory: an aurora was observed on the 25th; at 1.25 a. m. a pale white light was noticed in the north, extending from 20° west of north to 18° east of

north, and having an altitude of 15°. At times a ray of yellow light shot up to an altitude of 22°. Beneath the arch was plainly seen the dark segment which accompanies such displays.

Syracuse, New York: an aurora, extending from northeast to northwest and about 12° above the horizon, was observed during the evening of the 30th.

Auroral displays were also observed during the month, as follows:

1st.—Amherst, Massachusetts; Cresco, Iowa; New Haven, Connecticut; Fort Buford and Webster, Dakota; Saint Paul, Minnesota; Poplar River, Montana; Spokane Falls, Washington Territory.

2d.—Clinton, Iowa; Ithaca, New York.

3d.—Tiffin, Ohio.

4th.—Mackinaw City and Fort Brady, Michigan.

6th.—Pekin, Illinois.

8th.—Mountainville, New York.

11th.—Eastport, Maine; Fort Meade, Dakota; Orono, Maine.

12th.—Duluth, Minnesota.

14th.—Portland, Kent's Hill, and Eastport, Maine; Syracuse and Oswego, New York; Detroit, Michigan; Clinton and Monticello, Iowa; Traverse City, Michigan; Webster, Dakota.

19th.—Charlotte, Vermont; Pekin, Illinois.

20th.—Bar Harbor, Eastport, and Orono, Maine; North Volney, New York; Pekin, Illinois; Duluth, Minnesota; Mackinaw City, Michigan; Fort Meade and Fort Buford, Dakota.

24th.—Portland, Maine; Poplar River, Montana.

25th.—Newport, Vermont.

29th.—Eastport and Kent's Hill, Maine.

30th.—Eastport and Kent's Hill, Maine; North Volney and Syracuse, New York; Duluth, Minnesota; Pekin, Illinois.

#### REPORT ON THUNDER-STORMS OF APRIL, 1886.

(By Jr. Prof. H. A. Hazen.)

In this report there have been studied all observations from Signal Service stations, voluntary observers, and special thunder-storm observers. A summary of these reports is to be found in the following table:

TABLE I.—Thunder-storms of April, 1886.

District.	State.	1.	2.	3.	4.	5.	6.	7.	8.	9.	10.	11.	12.	13.	14.	15.	16.	17.	18.	19.	20.	21.	22.	23.	24.	25.	26.	27.	28.	29.	30.	Total.	
I	Connecticut													2							1				4							7	
	Maine																															0	
	Massachusetts																			3				8	1							12	
	New Hampshire																			1												1	
	New York						1							9						2	3			1	4		2	3		1		27	
	Rhode Island																								3							3	
	Vermont																			1					3					1		2	
	Total	1					1							11						7	4			1	19	1	2	3	1	1		52	
II	Delaware																															0	
	Maryland												2	4							2				10	3						21	
	New Jersey												1	3	1					3					8		4					20	
	North Carolina			1		1															2	2						1	3		7	17	
	Pennsylvania						1							3	1	2				8	1				16		4					36	
	Virginia and West Virginia													6							3	4				5	1					19	
	Total		1		1		1						3	16	2	2				16	7	2		34	8	9	1	3		7		113	
III	Illinois				1	1								4	4	18	7	1					1	1	1	4	4			1	7		54
	Indiana											3		2	2	11		1			3		1			13				4		40	
	Kentucky				1								1												1					2		6	
	Ohio			1	3						1		6	7	2	25	3	2		1	31				46	3	33	3	31	6		185	
	Tennessee			4	2	2	2	2				2			3			2								3	1		4	2		29	
	Total		5	7	3	2	2			1		6	7	13	11	55	10	6		1	34		1	1	27	7	54	4	1	48	8	314	
IV	Michigan													1	3	1	2	3	3		1			11		7						32	
	Minnesota													1	4	3	1			1			3			2	2					17	
	Wisconsin													2		6	2			1	1		1	3		5	5	1				27	
	Total													4	7	10	5	3	3	1	3	1	3	14		7	14	1				76	
V	Dakota													2	5	1				1	1	1	2									13	
	Iowa													4	2	2	5			1	1		2		2	2		1	6			28	
	Nebraska									1	2	1		4	1					1	1		4			2			1	4		22	
	Total									1	2	1		10	8	3	5			1	3	2	8		2	4		2	11			63	
VI	Arkansas		1	1	2																						1	1		2			17
	Indian Territory																3	2														0	
	Kansas			3	1						3	8	2		6	2	1	7	4						1	5	7	3	4		6		63
	Missouri			1	1										2	4	3	5	1	1					1	3	2	1		3	1		29
	Total	1	5	4						3	9	4		9	6	4	15	7	1				1	5	8	6	7	2		11	1		109
	Grand total	2	11	11	4	2	4		4	12	5	6	19	60	32	85	27	10	3	10	60	11	19	24	88	34	81	11	27	50	15	727	

The total number of storms recorded is seven hundred and twenty-seven; of these two hundred and eighty-eight are from voluntary observers, one hundred and sixty-two Signal Service, and two hundred and seventy-seven special records. It should be noted that in nearly all cases the reports of the voluntary observers enumerate the number of storms, including distant lightning, while in the last two classes distant lightning is omitted. The relative frequency of these storms for each state cannot be determined from the table, as some states have many more stations than others.

There were two specially marked periods of storms, the first from 13-16th with two hundred and the second from 23d-26th with two hundred and twenty-seven storms. There were two periods of lesser activity, 19th-21st with eighty-one and 28-30th with ninety-two storms. The storms of the 13-16th were the most interesting. These were first noted at Assinaboine, Montana, by a storm from 16.33 to 17.15 hours moving from sw. entirely to the west of the station.

The following table indicates several facts in regard to these storms:

TABLE II.

Date.	Station.	First thunder.	Loudest.	Duration.	Coming from.	Going towards.	Rain.	Hail.	Highest wind.		Intensity.
									Direction.	Velocity.	
		Hour.	Hour.	Minutes.			Inches.			Miles.	
April 12	Fort Assinaboine, Mont.....	16.33	17.05	42	sw.	nw.	.00	0	e.	19	a
	Fort Custer, Mont.....	17.28	17.45	42	sw.	ne.	Inap.	0	se.	15	
13	Fort Maginnis, Mont.....	22.40	22.50	30	e.	nw.	.04	0	sw.	28	a
	Valentine, Nebr.....	15.20	15.35	15	se.	nw.	.07	0	se.	40	
13	North Platte, Nebr.....	21.48	22.12	34	s.	se.	.05	0	se.	1	a
	Des Moines, Iowa.....	20.35	22.30	270	sw.	ne.	.14	0	sw.	10	
13	Lk. Cronse, Wis.....	21.47	21.55	33	se.	nw.	.02	0	se.	12	a
	Leavenworth, Kans.....	23.25	23.26	4	s.	ne.	.04	0	s.	17	
13	Chicago, Ill.....	18.07	18.07	53	se.	nw.	.07	0	e.	15	a
	Waukegan, Ill.....	15.15	16.05	75	sw.	n.	.36	Some	se.	Mod.	
14	Worthington, Minn.....	16.00	19.00	300	sw.	ne.	1.25	0	se.	Mod.	a
	Cresco, Iowa.....	18.15			n.	n.	.04	0	se.	Mod.	
14	Lansing, Mich.....	15.08	15.15	202	sw.	n.	.05	0	se.	Mod.	a
	Fort Yates, Dak.....	15.40	16.50	140	se.	nw.	.03				
14	Bismarck, Dak.....	15.47	15.56	118	se.	nw.	Inap.	Some.	se.	19	a
	Saint Paul, Minn.....	16.37	21.51	493	se.	nw.	1.43	Navy bean.	se. to sw.	27	
14	Fort Totten, Dak.....	17.30	18.20	90	n.	n.	.20	Small.	se.	32	a
	Independence, Kans.....	18.00	19.20		sw.	ene.	2.60	Some.	s.	20-30	
14	Yates Centre, Kans.....	18.10	18.30	110	n.	ne.?	.00	0	se.	20-30	a
	Duluth, Minn.....	18.10	19.30	320	sw.	ne.	2.23	0	se.	36	
14	Omaha, Nebr.....	19.02	19.06	10	e.	w.	.02	Size of peas.	se.	27	a
	Fort Buford, Dak.....	19.42	21.00	134	e.	w.	.60	0	e.	16	
14	Poplar River, Mont.....	20.40	20.40	1 clap	sw.	ne.	Inap.	0	sw.	12	a
	Celia, Kans.....	22.00	24.00	120	w.	e.	.00	Some.	w.		
14	Yates Centre, Kans.....	22.20	23.10	90	s.	nne.	.63	0	se.	20-30	a
	Lamar, Mo.....	22.20			sw.	ne.	.01	0			

This data is given somewhat in detail, as accompanying these storms were the destructive storms and tornadoes of April 14th, beginning with a small one at Jamestown, Dakota; then the most destructive of all at 15.58 hours at Saint Cloud, Minnesota; the next, at 17.00 hours or a few minutes after, at Coon Rapids, Iowa; then one at Shubert, Nebraska, just before 18.00 hours; and finally one at Monroe, Missouri, about 20.00 hours. Besides the above the newspapers of the Northwest give the names of at least thirty-four towns visited by destructive storms. It will be noticed that the duration of the storms was from a few minutes to more than eight hours. One of the most peculiar facts to be noted is the almost uniform occurrence of the highest wind from the se. A farther study of these conditions is being made.

It is very much desired that as the thunder-storm season approaches voluntary observers devote more attention to the details of these storms, which are now receiving very close attention in all countries. It is especially desired that some note of time be made; if it is impossible to note the first and loudest thunder with duration of storm, then note the approximate time of the passage of the heaviest part. Note the direction from which the storm comes and toward which it moves (it is very difficult to do this oftentimes in the house). The amount of rain, the fall of hail, the direction and approximate force of highest wind, and the intensity of the storm should also be noted. The last point is very important. The following scale of intensity may be used: (1) distant lightning (if no scale is used care should be taken never to include distant lightning with the dates of storms); (2) distant thunder; (3) moderate thunder-storm; (4) heavy thunder-storm; (5) heavy thunder with very high wind, breaking small branches off trees; (6) thunder with hurricane or tornado.

#### CHART OF ELECTROMETER READINGS.

Prof. T. C. Mendenhall, office of the Chief Signal Officer, has prepared chart vi (which shows the results of observations of the electrometer) and the following notes relating to the subject of atmospheric electricity:

Systematic observations of the electrical conditions of the atmosphere, as shown by the indications of an electrometer, have been carried on at one or two stations for two or three years. Within the past year this work has been greatly extended, and through the generous co-operation of the following institutions of learning and their professors of physics, stations have been established and observations are being made at the Massachusetts Institute of Technology, Yale College, Cornell University, the Ohio State University, and Johns Hopkins University. Regular observations are also made at the office of the Chief Signal Officer, Washington City. At all of these points the water dropping collector is in use. The electrometers are essentially the same, being the Thomson quadrant, as made by White, Carpentier, and others. At Baltimore the record is photographic and continuous. At other stations direct scale readings are made. Preparations are being made for photographic registration at all stations.

Beginning at noon on April 7th, a series of simultaneous observations at intervals of five minutes was kept up at all the above points for a period of seventy-two hours. Direct scale readings as frequent as once in five minutes furnish as satisfactory results as a photographic record, and indeed the method of direct reading has some decided advantages over the use of photography.

The results of these observations have been charted on a common scale, and when those made at different points are brought together they exhibit in some cases similarities of form of great interest. Simultaneous observations during shorter periods of time will be made in the future, and such results as appear to be of importance will be published in the MONTHLY WEATHER REVIEW. In this number chart vi shows some of the results of the series of observations referred to above.

The first two curves exhibit the results of observations at Washington City and Baltimore. The diagrams are self-explanatory. It will be observed that there are evidences of similarity in the general fluctuations, although each station shows considerable local disturbances.

The third curve exhibits simultaneous observations at Washington City and Columbus, Ohio. These stations are widely separated, but for this particular period of six or eight hours, the curves show a decided similarity. It will be remembered that the absolute potential recorded at any station depends so largely on the exposure of the collector that comparisons can only be made of the variations.

At Columbus the collector is exposed from the west side of a large building at a height of about thirty-five feet from the ground. At Baltimore and Washington City the exposure is also from windows at a height of about forty feet, south at Baltimore and north at Washington City.

The last diagram of the chart shows results of observations on two electrometers in Washington City, distant about three hundred feet from each other. The collector connected with one projects from the north side of a large building at a height of forty feet, while that joined to the other was suspended in the air, by means of a tall mast, at a height of about sixty feet from the ground.



and eight to ten feet above the roof of the building on which the mast was placed. The curves of this diagram show that the indications of collectors as near to each other as these were will often give practically identical results. At the same time it should be observed that local differences may, and do exist. Arrangements are now being made for the establishment of a station at the Smithsonian Institution, so that comparative observations at somewhat greater distances may be made.

The Chief Signal Officer recognizes the fact that the subject of atmospheric electricity is involved in great obscurity, but he desires to place some of the results of the observations now under way in the hands of those interested in the subject as early as possible. Much is to be done in the way of systematic observation and investigation before any generalization will be possible.

#### OPTICAL PHENOMENA.

##### SOLAR HALOS.

Solar halos were observed in the various states and territories during the month, as follows:

*Alabama.*—24th.  
*Arizona.*—10th, 19th.  
*Arkansas.*—8th, 12th, 23d, 27th.  
*California.*—2d, 4th, 5th, 8th, 9th, 11th, 14th, 18th, 19th, 21st, 24th.  
*Colorado.*—26th, 29th.  
*Connecticut.*—11th.  
*Dakota.*—4th, 7th, 17th, 25th, 30th.  
*District of Columbia.*—29th.  
*Florida.*—3d, 4th, 10th, 11th, 12th, 28th.  
*Georgia.*—3d, 11th, 17th, 25th, 27th.  
*Idaho.*—4th, 5th, 6th, 26th.  
*Illinois.*—3d, 4th, 6th to 9th, 12th, 14th, 21st, 23d, 26th, 28th.  
*Indiana.*—4th, 5th, 10th, 14th, 22d, 24th, 26th.  
*Iowa.*—5th to 8th, 16th, 17th, 22d, 24th, 27th.  
*Kansas.*—4th, 7th, 10th, 23d, 26th, 29th.  
*Kentucky.*—5th, 10th, 14th, 16th, 17th, 23d.  
*Maine.*—4th, 5th, 14th.  
*Massachusetts.*—10th, 11th, 15th, 27th.  
*Michigan.*—6th, 9th, 14th, 16th, 29th.  
*Minnesota.*—8th, 22d.  
*Missouri.*—8th.  
*Montana.*—1st, 5th, 7th.  
*Nevada.*—4th, 5th, 8th, 9th, 14th, 21st.  
*New Jersey.*—17th, 24th, 28th, 29th.  
*New York.*—8th, 9th, 11th, 15th, 17th, 18th, 19th, 21st, 22d, 23d, 25th, 30th.  
*North Carolina.*—4th, 10th, 11th, 18th, 19th, 24th, 25th, 29th.  
*Ohio.*—2d to 5th, 7th, 8th, 9th, 11th, 14th to 18th, 25th, 29th.  
*Oregon.*—4th, 5th, 25th, 27th, 28th.  
*Pennsylvania.*—3d, 10th, 11th, 14th, 15th, 18th, 24th, 30th.  
*South Carolina.*—3d, 4th, 11th, 21st, 25th, 27th, 28th.  
*Tennessee.*—8th, 9th, 10th, 14th, 18th, 25th, 26th, 27th.  
*Texas.*—2d, 11th, 13th.  
*Vermont.*—4th, 30th.  
*Virginia.*—2d, 10th, 11th, 14th, 20th, 24th, 27th, 29th.  
*Washington Territory.*—5th, 6th, 18th, 19th, 21st, 22d, 27th, 28th.  
*Wisconsin.*—6th, 7th, 8th, 17th, 22d.  
*Wyoming.*—1st, 6th, 7th, 9th, 10th, 11th, 13th, 16th, 25th, 29th, 30th.

##### LUNAR HALOS.

Lunar halos were observed in the various states and territories, as follows:

*Arizona.*—10th.  
*Arkansas.*—11th, 16th.  
*California.*—14th, 18th.  
*Colorado.*—13th.  
*Dakota.*—10th, 12th, 13th, 15th.  
*District of Columbia.*—10th, 11th, 12th, 14th, 15th, 19th.  
*Florida.*—11th, 12th, 15th.  
*Georgia.*—10th, 12th.  
*Idaho.*—11th, 16th.  
*Illinois.*—6th, 7th, 9th, 11th, 12th, 15th, 16th, 17th.  
*Indiana.*—1st, 8th, 9th, 13th, 15th, 17th, 18th, 22d, 24th.  
*Iowa.*—12th, 13th, 14th, 23d.  
*Kansas.*—11th, 13th, 14th, 16th.

*Kentucky.*—9th, 10th, 14th, 16th to 19th.

*Louisiana.*—11th.

*Maine.*—12th.

*Maryland.*—10th, 18th.

*Massachusetts.*—3d, 9th, 11th.

*Michigan.*—10th, 11th, 13th, 14th, 16th, 17th.

*Minnesota.*—12th, 14th, 17th.

*Mississippi.*—11th, 13th.

*Missouri.*—11th to 14th.

*Nebraska.*—15th, 16th.

*New Jersey.*—10th, 11th, 12th, 17th.

*New Mexico.*—10th.

*New York.*—9th, 10th, 12th, 14th to 19th.

*North Carolina.*—11th, 12th, 15th, 18th, 19th.

*Ohio.*—12th, 14th to 18th.

*Oregon.*—19th, 22d.

*Pennsylvania.*—9th, 12th, 14th.

*Rhode Island.*—12th.

*South Carolina.*—10th, 16th.

*Tennessee.*—7th, 12th, 13th, 14th, 16th.

*Texas.*—8th to 11th, 13th, 17th, 18th.

*Utah.*—16th.

*Vermont.*—12th, 14th.

*Virginia.*—10th, 11th, 14th, 17th, 18th, 19th.

*Washington Territory.*—11th, 15th, 16th, 25th.

*Wisconsin.*—9th, 13th, 14th, 15th, 17th.

*Wyoming.*—10th, 13th, 14th, 15th.

The phases of the moon (Washington mean time), as given in "The American Ephemeris and Nautical Almanac" for 1886, are as follows: new moon, 3d, 21 h. 22.4 m.; first quarter, 11th, 3 h. 35.8 m.; full moon, 17th, 21 h. 50.9 m.; last quarter, 25th, 12 h. 7.2 m.; apogee, 26th, 11.0 h.; perigee, 14th, 12.4 h.

##### MIRAGE.

Rochester, New York: on the afternoon of the 10th a very distinct mirage was seen at Rochester. Points nine miles distant, including Mount Hope and surroundings, were plainly discernible from the Rome, Watertown, and Ogdensburg Railroad track, near Charlotte. From the same point of view, the Erie Railroad, eight or nine miles distant, with moving train, was plainly seen.

Port Huron, Michigan: a mirage was observed at 5.30 p. m. of the 21st, northeast of this station; miles of ice and several small vessels could be distinctly seen over Lake Huron.

New Haven, Connecticut, 22d: on Long Island Sound vessels appeared elevated much above their actual position and under them their inverted images were seen; low lying land presented to view high bluffs.

Willcox, Arizona: mirage was observed every day during the month.

Mirage was also observed at the following places:

Duluth, Minnesota, 6th, 18th.

Mackinaw City, Michigan, 8th, 9th.

Oswego, New York, 11th.

Marquette, Michigan, 29th.

#### MISCELLANEOUS PHENOMENA.

##### EARTHQUAKE.

Bainbridge Island, Washington Territory: a slight earthquake was felt at 10.05 p. m. on the 16th; it had a tremulous motion and lasted about thirty seconds.

##### INSECTS.

Mr. John F. Bayerly, voluntary observer at Spartanburg, Spartanburg county, South Carolina, reports that grasshoppers have been seen in large numbers since the 15th.

##### METEORS.

Charlotte, North Carolina: a meteor was observed at 11.10 p. m. of the 20th. It descended rapidly at an angle of about 15° from the perpendicular. Meteors were also seen at this place on the 8th and 22d.

Walla Walla, Washington Territory: a large meteor was seen to fall from the heavens about 4.30 a. m. of the 19th, as it